Quick Update of Needs Analysis

In 2002 the Planning Services Section of the Transportation Planning Division was requested to provide an up date to the 1995 Needs Study and propose a new statewide need study, as well as conduct an inflation based update of the 1995 Needs Study. The results of the requested analysis were published in September of 2002 and are as follows:

- The 1995 Needs Study were calculated to be $**8.73** billion
- The 1995 Needs Study results adjusted for inflation would have resulted in 10 billion in needs.
- The 2002 (BRIGADOON[1]) update resulted in a 4% decrease or about of $8.38 billion of needs.

Updating BRIGADOON[2] and the 1995 Needs Study to today based just upon pavement and congestion deficiency current trends and inflation we see:

- 1995 needs number climb to close to $10.5 billion
- 2002 (BRIGADOON) estimate, adjusted for inflation and current pavement and congestion deficiency trends, is $9.2 billion.
- 2002 (BRIGADOON) estimate, adjusted for inflation and current pavement, congestion deficiency trends, and current rehabilitation and reconstruction projects selection trends is $10.9 billion.

These numbers reflect current trends and do not reflect current statewide model runs based on current local and state system performance data.

[1] See included report from 2002 for a detailed description of the BRIGADOON methodology.
[2] BRIGADOON is an outcome based methodology intended to measure and predict needs in context of the various types of uses for the total transportation infrastructure, not just the different modes and their current physical condition.

IDAHO TRANSPORTATION DEPARTMENT

DIVISION OF TRANSPORTATION PLANNING

TRANSPORTATION NEEDS STUDY
PHASE ONE REPORT

September 26, 2002

a.k.a. BRIGADOON

INTRODUCTION

Highway needs studies are documents that describe the deficiencies, or needs, of a highway system from a high-level, general, planning perspective. A consultant, Wilbur Smith & Associates, published the last Idaho statewide highway needs study in cooperation with the Idaho Transportation Department (ITD) in 1995. It incorporated an inventory of a sample of Idaho's roadways, both State and local jurisdictions (cities, counties, and highway districts). Field crews noted a long list of features and characteristics for a representative sample of Idaho's roadways. The study then expanded this statistical sampling to represent the entire roadway system.

The next step in the 1995 study was to compare the roadways' features to a set of minimum standards. Any features that did not meet these minimum standards were labeled as deficient and that roadway section was listed as having a need.

The highway needs study then summarized all the needy sections according to their deficient features. Using cost tables that report the average cost to remedy various deficiencies, the study reported the total dollar amount needs for these roadways.

What is BRIGADOON?

As the mythical city of Brigadoon magically appears every 100 years for a day, so also does a statewide highway needs study seem to receive attention every seven years. This current highway needs study reports the progress in resolving the highway needs described in the 1995 study. BRIGADOON further describes today's needs, not just on Idaho's highways, but for all the transportation system in ITD's jurisdiction.

The expansion of the acronym, BRIGADOON, is Broad Roadway Initiative Gathering Analysis Data Outlining Our Needs. It is a new and different philosophy in transportation needs analysis, being intermodal, mostly on ITD's transportation system, and based on performance measures. The full BRIGADOON report will be published at the end of 2002.

The full BRIGADOON study is divided into two phases.

Phase One

Phase one of the BRIGDOON study is a trend based update of the 1995 highway needs study. The results of phase one will be a trend factor that can be applied to the results of the 1995 study to bring the results of that study to the present. Also, the results can be used as a baseline to project forward, which will help determine future needs. This trend development is described in more detail on page 4.

Phase Two

The second BRIGADOON phase differs from the 1995 study in three major ways.

1. The 1995 study reported on only roads and bridges, the "highways" mode. BRIGADOON reports needs for all modes, including highways, aeronautics, commercial vehicles, public transportation, bicycles, pedestrians, and railways.

2. The 1995 study included all roadways of the state, including roadways under State, county, highway district, and city jurisdiction. BRIGADOON concentrates mostly on the transportation needs under the jurisdiction of ITD, with a few intermodal connector facilities from local agencies included.

3. The 1995 study compared the roadways' features to certain minimum tolerable condition (MTC) standards. Any feature that was less than its MTC was considered deficient and generated a need. BRIGADOON compares ITD's transportation facilities to published and recently developed performance measures. ITD's performance measures are goals established for a level of efficiency or quality we expect for the transportation systems. Any performance measure that is not being met will generate a need.

   Examples of MTC standards are: Lane width 12 feet, pavement index greater than 2.5, bridge rating higher than 50.

   Examples of performance measures are: No more than 20% of roadways above 80% capacity, no more than 15% of pavements deficient, no more than 46 deficient bridges on the system.

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Phase One Study Methodology

As stated in the introduction, phase one of BRIGADOON is intended to update the results of the 1995 highway needs study. To accomplish this goal, the study team determined needs for each year from 1996 to 2001. From these yearly needs assessments, a trend was developed and applied to the 1995 study results.

1996 – 2001 Trend Development

To develop the annual needs for the chosen timeframe, the study team needed a statewide sample of highway mileage to examine. The team chose the annual Highway Performance Monitoring System (HPMS) submittal dataset. This dataset includes a statistically valid sample of all of Idaho's highways down to the Major Collector functional class. This set also represents the highways which have the majority of the highway needs. Results from previous needs studies indicate that highway needs in the lower functional classes are maintenance needs and do not represent a large portion of needs in the final results. The HPMS dataset was also chosen because it is a nationally

accepted source of data by major research institutions as well as used by the FHWA for national needs assessments.

After an appropriate dataset was chosen for the study, the study team then chose the Idaho version of the HPMS-Analytical Process (HPMS-AP) highway needs computer model to develop the annual highway needs. This model was chosen for the following reasons.

- The Idaho HPMS-AP is used annually by ITD to determine state system needs and is accepted as valid.

- It is similar enough to the HPMS-AP version used in the 1995 study.

- It is a nationally accepted and supported system used by the FHWA for national needs studies

After the study team selected the needs model and input data sets, the MTCs were reviewed to determine if adjustments were needed to reflect current engineering standards and practices. See Appendix A for MTCs used in this study. Using the HPMS-AP, the datasets for 1996 thru 2000 were processed by the model and deficiencies and types of improvement (TOI) were identified. A TOI is an improvement selected to fix one or more deficiencies detected by the computer model based on the MTCs. After the model processed the data, TOIs were reviewed for reasonableness and the data was checked for correctness. If any errors were identified during this process, the data or process was corrected and data reprocessed until the results were reasonable.

After the annual needs were deemed reasonable, a trend was developed for the years 1996 – 2001. This trend is based upon the miles of improvement identified in each year of the model runs. The trend is developed by plotting the points representing miles of roadways with needs for 1996-2001, then finding the mathematical equation for the best fit line through those points. The developed trend then was applied to the 1995 study results. See Graph 1.

Further results of this phase of the BRIGADOON study was an analysis of the individual deficiency trends. The study team analyzed each individual type of need (such as pavement condition, congestion, bridges, number of lanes, shoulder width, lane width, etc.) determined whether it increased or decreased, and the magnitude of that change. The team also analyzed whether sufficient highway funding has been expended to justify the decrease in needs.

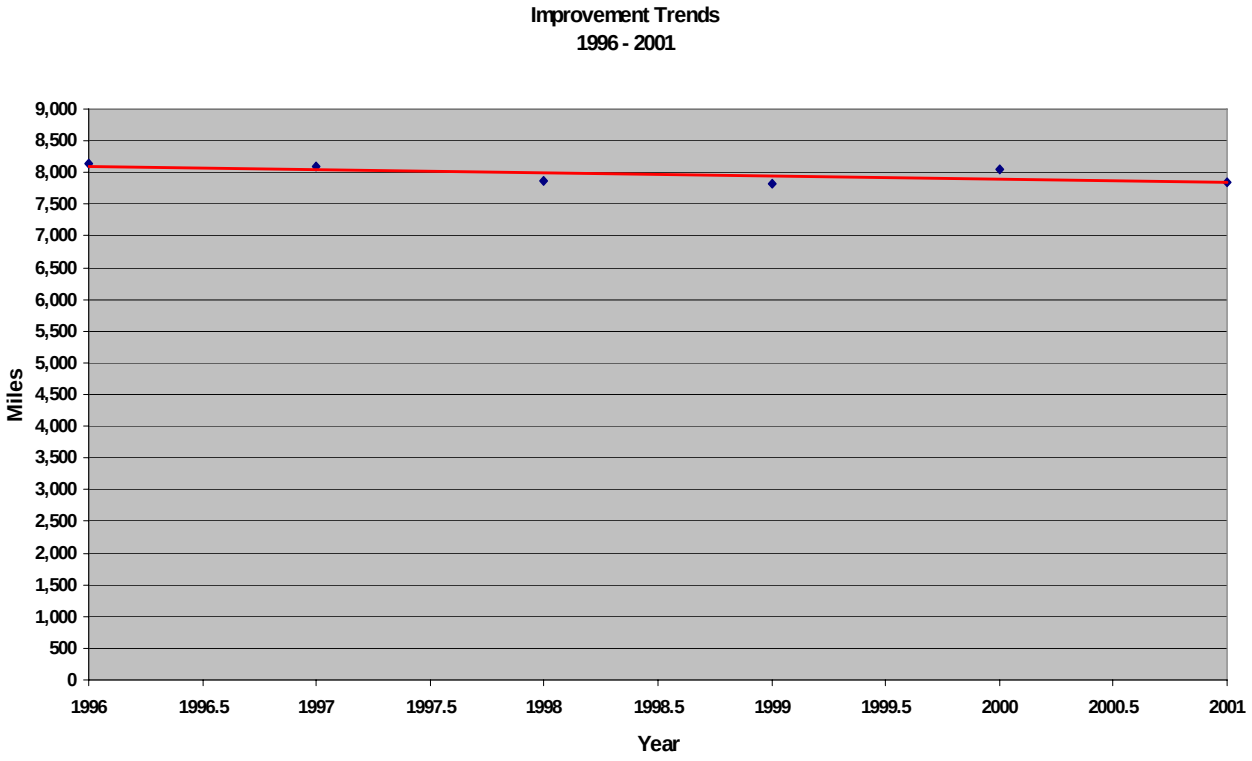
A root-cause analysis was conducted to explain the results and conclusions reached. This is an analysis to logically investigate the cause for change. The study team investigated the causal relationship between changes in highway features and the overall needs.

Findings

Finding #1

The first goal of the BRIGADOON study is to update the 1995 needs study. From the previous section of this report, a trend was developed and applied to the 1995 results. The results of this method were surprising to the study team. They expected, as is typical in public agencies, to find an increase in needs. The team found a decrease of 4% in overall needs from 1996 – 2001. See Graph 1.

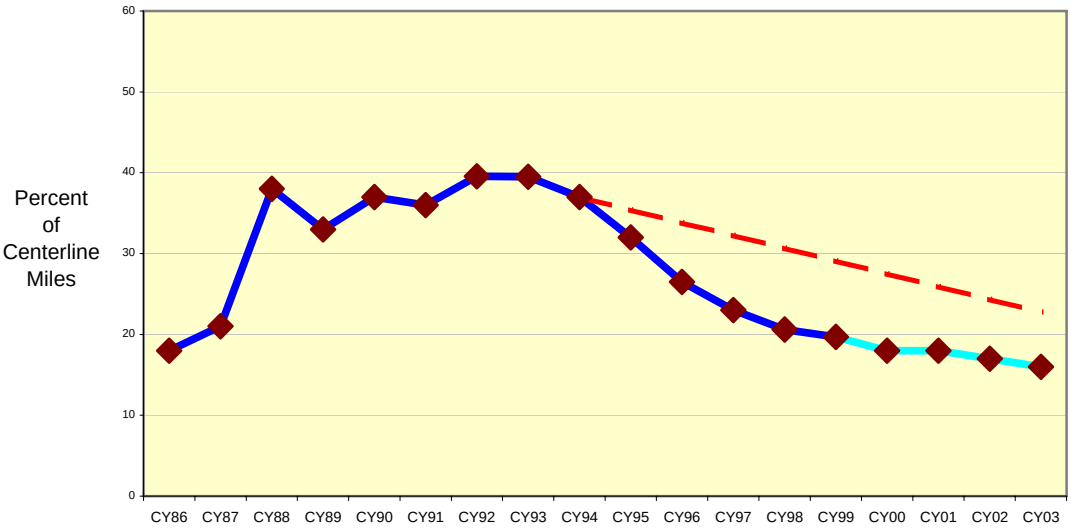
Graph 1



This result seemed to be in conflict with common accepted perceptions. The study team conducted a root-cause analysis to logically determine whether a 4% decrease in needs was possible, which specific needs decreased enough to cause a decrease in overall needs, and the causal relationship between changes in highway features and the overall needs. The root-cause analysis revealed the following:

1. Current highway needs assessment models are biased towards pavement condition. Needs assessment models are programmed to be reluctant to call for roadway reconstruction for minor needs until the pavement condition is also in need. Pavement condition is weighted heavily in the models as the primary need, therefore changes to the pavement condition profoundly affect the overall needs.

2. Over the last half a decade, ITD has focused on reducing pavement needs from 36% of roadways having pavement deficiencies to 18%. See Graph 2.



3. The 5000 mi of the State Highway System represent mostly high volume, high functional class roads and therefore represent a disproportionate amount of needs based on miles of total system.

Therefore the drop in needs statewide by 4% is explained by the focus ITD has placed in reducing pavement deficiencies in half over the same timeframe as this study.

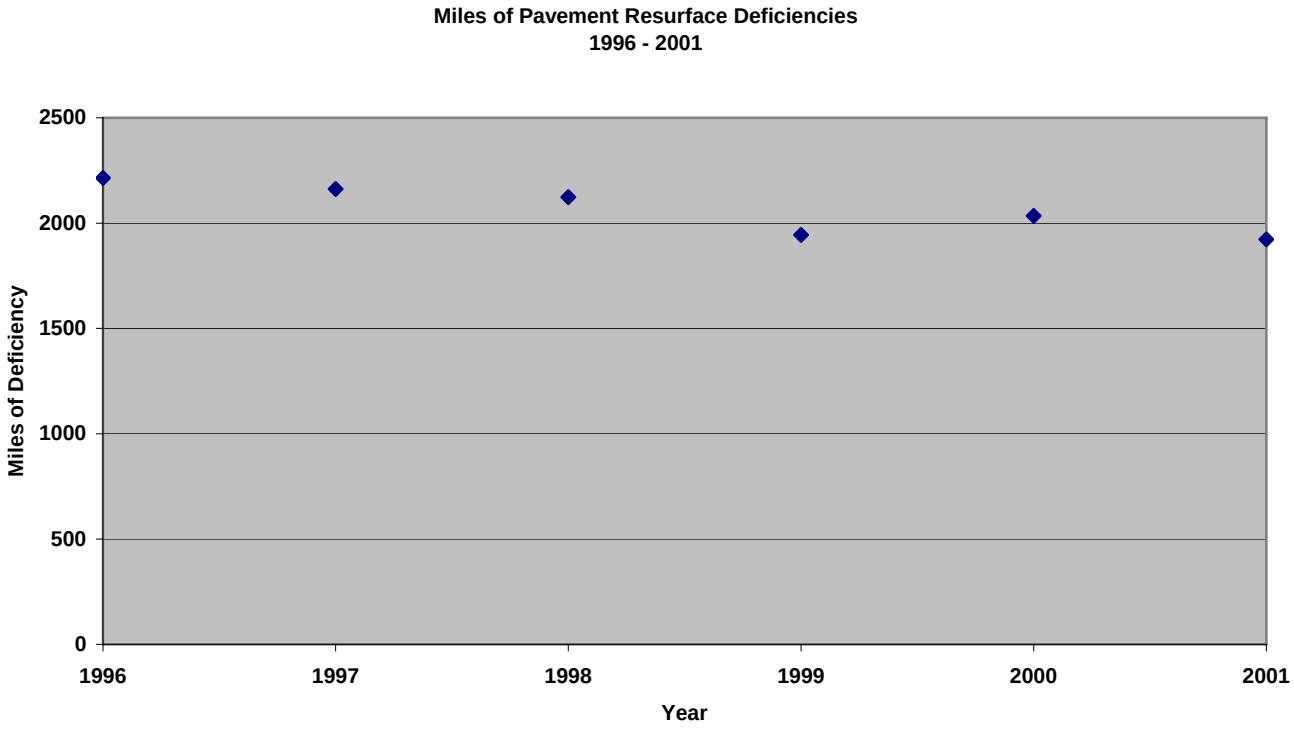
Therefore the study team accepted a decrease of 4% in overall statewide needs for the study period of 1996 to 2001.

The 1995 needs, calculated as $**8.73** billion, decreased by 4%, results in an updated amount of $8.38 billion of needs as of 2001.

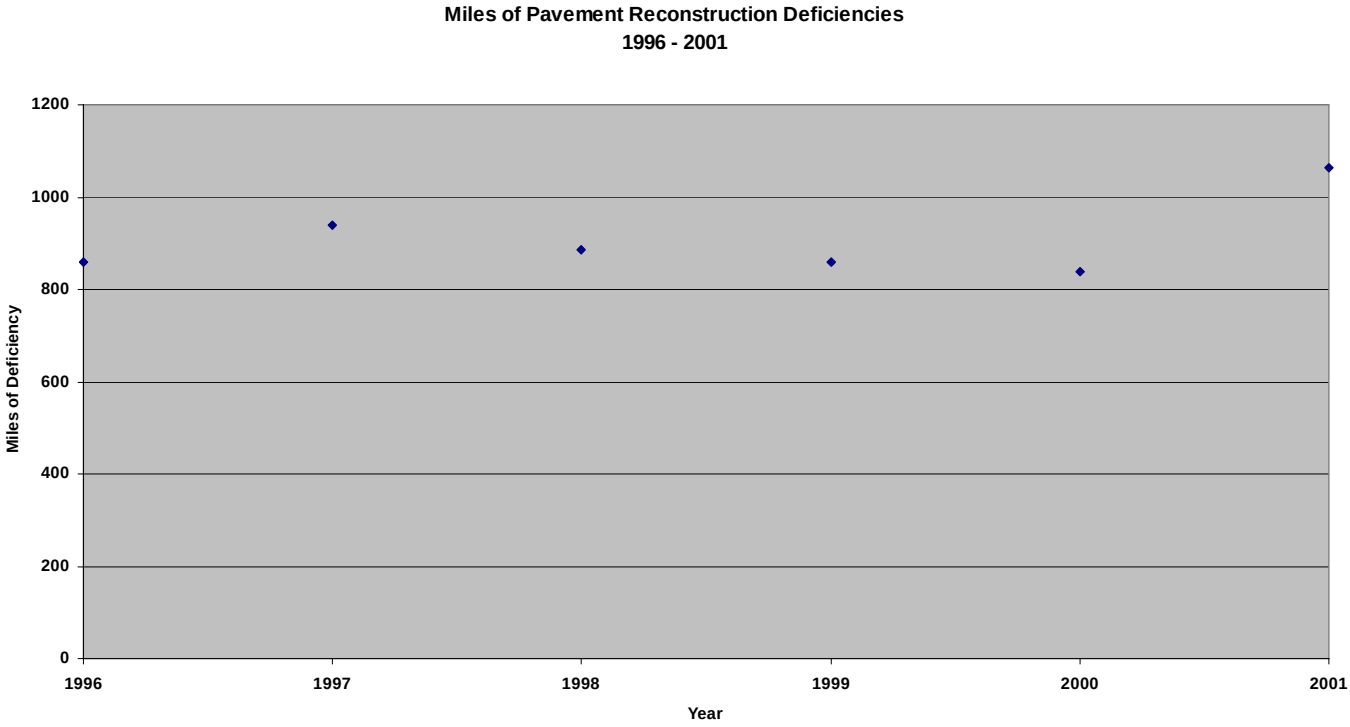
The overall trend analysis shows that as the State Highway System pavement deficiency has dramatically decreased, so have the statewide highway needs slightly decreased. After the overall trend analysis was established and verified, the trends for individual pavement types of improvement (resurfacing and reconstruction) were examined. This showed that the resurface and reconstruction needs generally followed the overall pavement trend. As the statewide pavement needs have decreased, so have the State Highway System resurface and reconstruction needs.

As the study team analyzed the specific pavement resurface and reconstruction trends, another result became evident that some of the deficiency and TOI trends are starting to level off and then increase again. See Graphs 3 - 5 below.

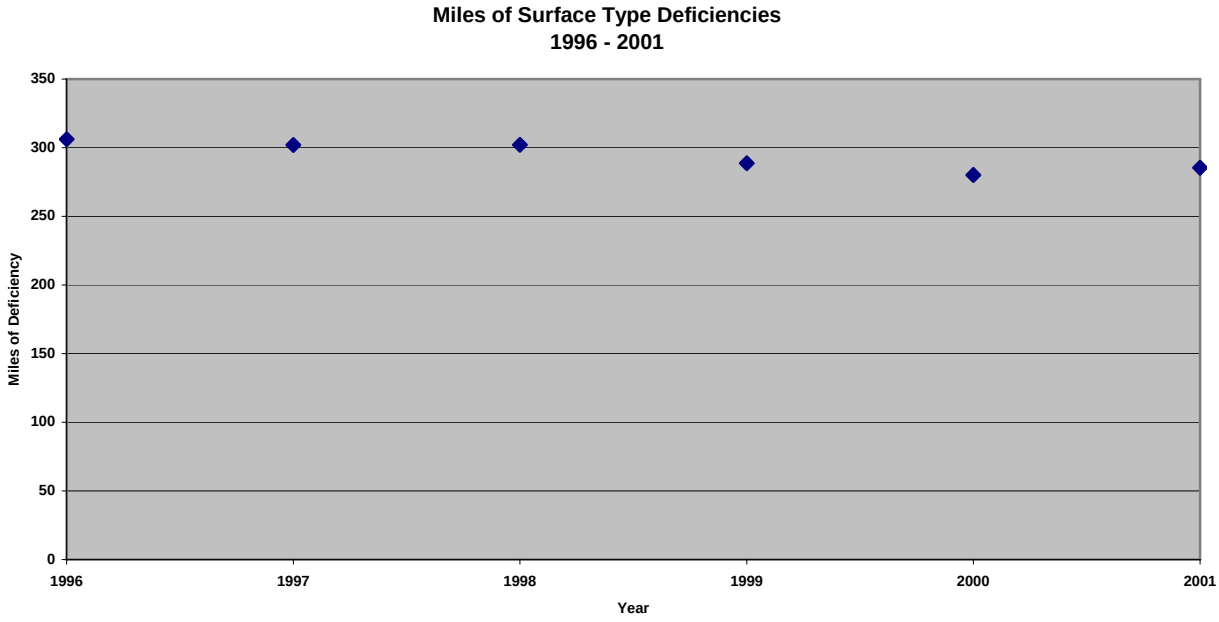
Graph 3



Graph 4



Graph 5



Finding #2

The Planning Services Section of ITD has noticed a leveling off of overall pavement deficiencies on the state highway system over the last couple of years and is expecting a small upward trend in the coming years. Given the pavement sensitive nature of needs models, the study team found that overall needs (based on the turnaround in the deficiency trends) should start to increase as well in the next few years.

Recommendation:

The study team recommends that the current policy concerning pavement deficiencies be examined in light of these findings and adjusted to reflect the expected trends in pavement and other future deficiencies.

BRIGADOON Phase Two

With the completion of this report, Phase Two of this study has started. This part of the study will look into the near future to determine what the needs will be.

Unlike the 1995 needs study, BRIGADOON Phase Two will focus on transportation system performance measures and goals not just a physical analysis of the pavement structure against MTCs. This phase will also look at other modes of the transportation system and take the performance goals of those systems into account as well as surface transportation in the classical sense. Given the recent nature of these types of studies, this phase will focus on the state system where the study team has the most complete dataset. Local jurisdiction roads will be added to accommodate the intermodal connections needed for completeness.

Appendix A

URBAN MINIMUM TOLERABLE CONDITION (MTC) TABLE

	INTERSTATE	OTHER FREEWAYS AND EXPRESSWAYS	OTHER PRINCIPAL ARTERIALS	MINOR ARTERIALS	COLLECTORS
VOLUME-TO-CAPACITY RATIO	0.80	0.85	0.85	0.90	0.95
LANE WIDTH	12	12	12	12	12
SURFACE TYPE	1	1	1	1	1
PAVEMENT CONDITION	2.8	2.5	2.5	2.0	2.0
SHOULDER TYPE	1	1	2	3	3
RIGHT SHOULDER WIDTH	10	10	8	6	6

SHOULDER TYPE CODES:
1 – SURFACED
2 – STABILIZED
3 – EARTH
4 – CURBED

SURFACE TYPE CODES:
1 - HIGH FLEXIBLE
2 - HIGH RIGID
3 – INTERMEDIATE
4 – LOW
5 – GRAVEL

URBAN DESIGN STANDARDS TABLE

	FREEWAY/EXPRESSWAY BY DESIGN		OTHER DIVIDED		UNDIVIDED ARTERIALS		UNDIVIDED COLLECTORS	
	BUILT-UP	OUTLYING	BUILT-UP	OUTLYING	BUILT-UP	OUTLYING	BUILT-UP	OUTLYING
AVERAGE HIGHWAY SPEED	55	65	--	--	--	--	--	--
MEDIAN WIDTH	16	24	--	--	--	--	--	--
LANE WIDTH	12	12	12	12	12	12	12	12
RIGHT SHOULDER WIDTH*	10	10	10	10	8	10	6	10
LEFT SHOULDER WIDTH*	4	4	4	4	--	--	--	--
SURFACE TYPE	2	2	1	1	1	1	1	1

* FOR FACILITY WHICH IS NOT CURBED.
SURFACE TYPE CODES:
1 - HIGH FLEXIBLE
2 - HIGH RIGID
3 - INTERMEDIATE
4 - LOW
5 - GRAVEL

AVERAGE HIGHWAY SPEED: AVERAGE HIGHWAY SPEED IS DEFINED AS THE WEIGHTED AVERAGE DESIGN SPEED.

RURAL MINIMUM TOLERABLE CONDITION (MTC) TABLE

	INTERSTATE			OTHER PRINCIPAL ARTERIALS						MINOR ARTERIALS						MAJOR AND MINOR COLLECTORS								
ADT	ALL ADT			> 6000			< OR = 6000			> 2000			< OR = 2000			> 1000			400 - 1000			< 400		
TERRAIN	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M
LANE WIDTH	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	10	10	10
RIGHT SHOULDER WIDTH	10	10	8	8	8	6	8	8	6	8	8	6	6	6	6	6	6	4	4	4	4	2	2	2
SHOULDER TYPE	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3
PAVEMENT CONDITION	2.8	2.8	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.2	2.2	2.2	2.0	2.0	2.0	2.0	2.0	2.0	1.8	1.8	1.8
V/C RATIO	0.75	0.80	0.85	0.75	0.80	0.85	0.75	0.85	0.90	0.75	0.85	0.95	0.75	0.85	0.95	0.75	0.85	0.95	1.00	1.00	1.00	1.00	1.00	1.00
SURFACE TYPE	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3
HORIZONTAL ALIGNMENT	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	3	3	3	3	3	3
VERTICAL ALIGNMENT	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	3	3	3	3	3	3

NOTES: TERRAIN TYPES ARE FLAT, ROLLING AND MOUNTAINOUS.
MTC SHOWN FOR LANE WIDTH ON COLLECTORS GROUP 3 ARE FOR SURFACE WIDTH.

SHOULDER TYPE CODES:
1 – SURFACED
2 – STABILIZED
3 – EARTH
4 – CURBED

SURFACE TYPE CODES:
1 - HIGH FLEXIBLE
2 - HIGH RIGID
3 – INTERMEDIATE
4 – LOW
5 – GRAVEL

HORIZONTAL/VERTICAL ALIGNMENT CODES:
1 - ALL CURVES/GRADES MEET DESIGN STANDARDS.
2 - SOME CURVES/GRADES BELOW DESIGN STANDARDS.
3 - CURVES/GRADES WITH REDUCED SPEED.
4 - SEVERAL CURVES UNSAFE/SIGNIFICANT REDUCTION OF SPEED ON GRADES

RURAL DESIGN STANDARDS TABLE

	INTERSTATE			OTHER PRINCIPAL ARTERIALS						MINOR ARTERIALS						MAJOR AND MINOR COLLECTORS								
DESIGN ADT	ALL ADT			> 6000			< OR = 6000			> 2000			< OR = 2000			> 1000			400 - 1000			< 400		
TERRAIN	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M	F	R	M
SHOULDER WIDTH	10	10	8	10	10	8	10	10	8	8	8	8	8	8	6	8	8	6	4	4	4	2	2	2
SURFACE TYPE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MEDIAN WIDTH	64	64	16	40	40	16	40	40	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LANE WIDTH	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	10	10	10
AVERAGE HIGHWAY SPEED	70	70	55	70	65	55	70	65	55	70	60	50	65	55	45	65	55	45	60	50	40	50	40	30

SURFACE TYPE CODES:
1 - HIGH FLEXIBLE
2 – HIGH RIGID
3 - INTERMEDIATE
4 - LOW
5 - GRAVEL

AVERAGE HIGHWAY SPEED: AVERAGE HIGHWAY SPEED IS DEFINED AS THE WEIGHTED AVERAGE DESIGN SPEED.